

What is claimed is:

1. A semi-solid metal (SSM) casting process, comprising:  
heating one from the group consisting of Al-Si alloy or a grain refiner;  
mixing the Al-Si alloy and the grain refiner to create a mixture;  
cooling the mixture; and  
casting the mixture.
2. The SSM casting process according to claim 1, wherein the mixture is cooled until a semi-solid is formed.
3. The SSM casting process according to claim 1, further comprising heating both the Al-Si alloy and the grain refiner.
4. The SSM casting process according to claim 1, wherein in the grain refiner a controlled level of a titanium alloy.
5. The SSM casting process as in claim 4, wherein the titanium alloy is combined with an element selected from the group consisting of boron, carbon, sulfur, phosphorus, and nitrogen.
6. The SSM casting process as in claim 1, wherein the grain refiner is a material in combination with titanium that operates to provide grain refining nuclei.

7. The SSM casting process as in claim 1, wherein the grain refiner is a titanium boron alloy.
8. The SSM casting process according to claim 7, wherein the titanium boron alloy is less than about 10 percent titanium by weight.
9. An SSM casting process according to claim 7, wherein the amount of titanium boron alloy is chosen to achieve a cast product having Al particles with an average diameter ranging from about 40 microns to about 60 microns.
10. An SSM casting process according to claim 7, wherein the amount of titanium boron alloy is chosen to achieve a cast product having Al particles with an average diameter of 70 microns or less.
11. An SSM casting process according to claim 7, wherein the amount of titanium boron alloy is chosen to achieve a cast product with Al particles that are more uniformly dispersed than a cast product made by a conventional SSM rheocasting process without the addition of a titanium boron alloy.
12. An SSM casting process according to claim 1 wherein said Al-Si alloy is a hypoeutectic alloy.
13. An SSM casting process according to claim 12, wherein said hypoeutectic alloy is less than about 11.7 percent Si by weight.

14. An SSM casting process according to claim 12, wherein said hypoeutectic alloy is about 6 percent to about 8 percent Si by weight.
15. An SSM casting process according to claim 12, wherein said hypoeutectic alloy is a 357 alloy.
16. An SSM casting process according to claim 7, wherein the titanium from the titanium boron alloy ranges from about 0.01 percent to about 5% by weight of a hypoeutectic Al-Si alloy.
17. An SSM casting process according to claim 12, wherein the temperature of said hypoeutectic alloy is greater than about 600°C.
18. The SSM casting process according to claim 1, wherein the grain refiner is selected from the group consisting of niobium, tantalum, vanadium, molybdenum, zirconium and beryllium.
19. A product from a semi-solid metal (SSM) casting process, comprising:
  - heating one from the group consisting of Al-Si hypoeutectic alloy or grain refiner;
  - mixing the Al-Si alloy and the grain refiner to create a mixture;
  - and
  - casting the mixture.
20. The product from the SSM casting process as in claim 17, further comprising cooling the mixture for a length of time.

21. The product from the SSM casting process as in claim 17, where the grain refiner is a titanium alloy.

22. The product from the SSM casting process as in claim 19, wherein the titanium alloy is a titanium boron alloy.

23. The product from the SSM casting process as in claim 20, wherein the Al particles have less than an average diameter ranging from about 60 microns to about 100 microns.

24. A cast product according to claim 19, wherein the Al particles have less than an average diameter of about 70 microns or less.

25. A cast product according to claim 15, wherein the amount of titanium boron alloy yields Al particles in the cast product that are more uniformly dispersed than a cast product made by a conventional SSM rheocasting process without the use of the titanium boron alloy.

26. A system for creating a semi-solid metal (SSM) casting, comprising:  
means for mixing an Al-Si alloy and a grain refiner to create a mixture;  
means for cooling the mixture; and  
means for casting the mixture.

27. A semi-solid casting (SSM) material comprising
- an Al-Si alloy;
  - a grain refiner inserted into the Al-Si alloy;
  - a mixer that holds the Al-Si alloy and grain refiner to create a mixture; and
  - a cast that forms a casting with the mixture.
28. The casting as in claim 25, wherein the grain refiner is a material in combination with titanium that operates to provide grain refining nuclei.
29. The SSM casting as in claim 26, wherein the grain refiner is a controlled level of a titanium alloy.
30. The SSM casting as in claim 27, wherein the titanium alloy is combined with an element selected from the group consisting of boron, carbon, sulfur, phosphorous and nitrogen.